POSITIONS AND AREAS OF SUN SPOTS—Continued

[Communicated by Capt. C. S. Freeman, Superintendent U. S. Naval Observatory]

[Data furnished by Naval Observatory, in cooperation with Harvard, Yerkes, and Mount Wilson Observatories]

[The differences of longitude are measured from central meridian, positive west. The north latitudes are plus. Areas are corrected for foreshortening and are expressed in millionths of sun's visible hemisphere. The total area, including spots and groups, is given for each day in the last column]

Date	Eastern standard civil time	Heliographic			Area		Total area for each day
		Diff. long.	Longitude	Latitude	Spot	Group	
1928	h. m.	°	°	°			
June 29 (Naval Observatory).	11 51	−50.5	154.5	+5.0	.....	25	.....
		−46.5	158.5	+19.0	.....	46	.....
		−45.0	160.0	+5.0	6	.....	.....
		−32.5	172.5	+8.0	43	.....	.....
		−14.0	191.0	+10.0	3	.....	.....
		−9.5	195.5	+18.0	216	.....	.....
		−4.0	201.0	+18.0	.....	108	.....
		+3.0	208.0	+17.0	.....	46	.....
		+10.5	215.5	−19.5	.....	463	.....
		+20.0	225.0	+11.5	52	.....	.....
		+28.5	233.5	−12.0	108	.....	.....
		+34.0	239.0	−10.0	.....	3	.....
		+44.5	249.5	+9.0	.....	93	1,212
June 30 (Harvard).....	8 50	−36.5	157.0	+6.5	.....	56	.....
		−35.0	158.5	+20.0	.....	39	.....
		−22.0	171.5	+9.0	65	.....	.....
		+6.0	199.5	+18.0	.....	573	.....
		+23.5	217.0	−20.0	.....	880	.....
		+30.5	224.0	+12.5	.....	54	.....
		+39.0	232.5	−12.5	203	.....	.....
		+56.5	250.0	+9.0	113	.....	1,983
Mean daily area for June.....							979

PROVISIONAL SUNSPOT RELATIVE NUMBERS FOR MAY, 1928

[Data furnished by Prof. A. Wolfer, University of Zurich, Switzerland]

May	Relative numbers	May	Relative numbers	May	Relative numbers
1	124	11	85	21	14
2	126	12	62	22	22
3	126	13	34	23	41
4	109	14	26	24	34
5	114	15	15	25	49
6	117	16	16	26	40
7	142	17	15	27	54
8	133	18	13	28	112
9	146	19	15	29	139
10	119	20	0?	30	150
				31	153

Number of observations, 31; mean, 75.6.

PROVISIONAL SUNSPOT RELATIVE NUMBERS FOR JUNE, 1928

[Data furnished by Prof. A. Wolfer, University of Zurich, Switzerland]

June	Relative numbers	June	Relative numbers	June	Relative numbers
1	134	11	24	21	89
2	133	12	7	22	109
3	110	13	29	23	131
4	100	14	25	24	145
5	98	15	43	25	154
6	90	16	53	26	134
7	95	17	64	27	145
8	74	18	62	28	126
9	43	19	94	29	134
10	32	20	63	30	114

Number of observations, 30; mean, 88.5.

AEROLOGICAL OBSERVATIONS

By W. R. STEVENS

Free-air temperatures for June were mostly below normal except at Washington. Aside from a gradual increase at Ellendale, departures from normal decreased with altitude. It was the coolest June of record at Broken Arrow and Royal Center, and with but one exception at Due West and Ellendale. The lowest June temperature was recorded during the month at the two latter stations.

Relative humidities averaged slightly above normal.

Vapor pressures were somewhat above normal at Broken Arrow, Due West and Washington, and below at Ellendale, Groesbeck and Royal Center.

Resultant winds were almost entirely of southerly component at and near the surface. The area of winds of northerly component gradually increased with altitude from north to south, and at an altitude of 6,000 meters included practically the entire country.

Every station obtained an unusually large number of kite flights shortly before the occurrence of thunderstorms and a few when the storms were in progress. In one instance it is believed that the wire was actually struck by lightning. The official in charge at Ellendale says in this connection:

> At about 2,600 meters out, while reeling in the flight of the 27th, the head kite broke away with about 200 meters of wire. The cause of the break is not definitely known but from the appearance of the kite bridle, which was slightly burned, it would seem that a mild lightning discharge struck it. This flight is of more or less interest in that it was made in a somewhat threatening condition. Light rain fell during the flight, beginning at 8.22 a. m. and continuing through the flight. The conditions were ripe for thunderstorm development. Static discharges were high, some measurements being greatly in excess of 10,000 volts.—*L. A. Warren.*

Special observations were made on the 28th, 29th and 30th at a number of selected balloon stations and forwarded to Detroit for the information of contestants in the international Gordon Bennett balloon race.

TABLE 1.—*Free-air temperatures, relative humidities, and vapor pressures during June, 1928*

TEMPERATURE (° C.)

Altitude m. s. l. (meters)	Broken Arrow, Okla. (233 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Royal Center, Ind. (225 meters)		Washington, D. C.[1] (7 meters)	
	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal
Surface	23.4	−1.5	24.6	−1.4	16.2	−2.5	23.9	−2.0	17.5	−4.3	26.2	+2.8
250	23.2	−1.6	24.2	−1.4	.....	.....	23.0	−1.9	17.2	−4.3	23.5	+2.1
500	21.1	−1.8	21.7	−1.3	15.8	−2.5	21.0	−1.9	15.7	−3.2	21.0	+1.2
750	19.6	−1.8	20.2	−1.1	14.0	−2.7	19.9	−1.5	14.3	−2.8	19.0	+0.9
1,000	18.3	−1.8	18.6	−1.1	12.5	−2.8	19.7	−0.6	12.9	−2.7	17.3	+0.6
1,250	17.0	−1.8	17.2	−0.9	10.6	−3.4	19.3	+0.1	11.8	−2.3	15.5	+0.4
1,500	15.9	−1.6	15.7	−0.7	9.2	−3.5	18.9	+0.8	10.7	−2.1	13.7	+0.1
2,000	14.1	−0.7	12.6	−0.5	6.2	−3.6	16.8	+1.0	8.5	−1.7	10.4	−0.2
2,500	12.2	+0.2	9.6	−0.4	2.9	−4.0	14.0	+0.8	6.5	−1.0	7.5	−0.4
3,000	9.6	+0.6	6.4	−0.5	−0.1	−4.2	10.8	+0.3	4.3	−0.5	4.6	−0.4
3,500	7.4	+1.5	3.6	−0.1	−3.3	−4.5	.....	.....	2.1	−0.1	.....	.....
4,000	5.6	+2.8	0.4	−0.4	−6.1	−4.5	.....	.....	0.1	+0.3	.....	.....
4,500	.....	.....	−2.4	−0.8	−9.3	−4.6	.....	.....	−1.7	+1.2	.....	.....
5,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

[1] Naval air station.

TABLE 1.—*Free-air temperatures, relative humidities, and vapor pressures during June, 1928*—Continued

RELATIVE HUMIDITY (%)

Altitude m. s. l. (meters)	Broken Arrow, Okla. (233 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Royal Center, Ind. (225 meters)		Washington, D. C.[1] (7 meters)	
	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal
Surface	77	+5	69	+5	69	−1	83	+8	74	+8	62	−3
250	77	+5	70	+6			85	+9	74	+8	65	−4
500	80	+8	73	+6	68	−1	87	+9	72	+5	68	+2
750	81	+9	73	+5	68	+1	82	+5	72	+4	68	+3
1,000	82	+11	73	+4	68	+2	69	−3	74	+6	66	+3
1,250	79	+10	70	+1	70	+5	59	−8	74	+6	66	+2
1,500	74	+7	69	−1	69	+6	47	−15	73	+7	68	+5
2,000	64	+3	65	−5	63	+2	39	−15	65	+4	70	+5
2,500	49	−5	68	−2	64	+4	31	−18	64	+9	68	+8
3,000	42	−8	64	−3	62	+6	27	−19	59	+8	63	+5
3,500	36	−13	64	−1	60	+8			60	+15		
4,000	29	−19	62	+2	55	+7			72	+32		
4,500			62	+10	64	+17			72	+32		
5,000												

[1] Naval air station.

TABLE 1.—*Free-air temperatures, relative humidities, and vapor pressures during June, 1928*—Continued

VAPOR PRESSURE (*mb.*)

Altitude m. s. l. (meters)	Broken Arrow, Okla. (233 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Royal Center, Ind. (225 meters)		Washington, D. C.[1] (7 meters)	
	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal
Surface	22.65	+0.03	21.28	+0.35	12.89	−2.40	24.82	+0.21	15.04	−2.28	21.40	+2.08
250	22.51	+0.09	20.93	+0.33			23.95	+0.20	14.71	−2.33	19.10	+1.54
500	20.70	+0.61	18.82	+0.37	12.46	−2.36	21.72	+0.01	13.16	−1.72	17.09	+1.60
750	19.16	+0.99	17.10	+0.27	11.16	−1.86	19.06	−0.56	12.06	−1.51	15.18	+1.28
1,000	17.87	+1.32	15.51	0.00	10.08	−1.65	15.66	−1.39	11.30	−1.19	13.29	+0.74
1,250	16.07	+1.25	13.52	−0.65	9.18	−1.42	12.93	−1.92	10.44	−1.02	11.87	+0.66
1,500	13.83	+0.70	12.00	−0.92	8.24	−1.19	9.92	−2.86	9.61	−0.66	10.87	+0.72
2,000	10.40	+0.38	9.20	−1.24	6.13	−1.47	6.93	−2.70	7.43	−0.47	8.72	+0.23
2,500	7.52	+0.14	8.12	−0.28	4.96	−1.30	4.56	−2.95	6.27	+0.51	6.84	+0.51
3,000	5.94	+0.35	6.41	−0.16	3.83	−1.00	2.94	−3.00	4.87	+0.58	5.03	+0.08
3,500	5.13	+0.63	5.19	+0.13	2.91	−0.93			4.27	+1.26		
4,000	4.49	+0.81	4.36	+0.60	2.09	−1.03			4.65	+2.47		
4,500			3.72	+1.02	1.89	−0.58			4.56	+2.74		
5,000												

TABLE 2.—*Free-air resultant winds (m. p. s.) during June, 1928*

Altitude M. S. L. (meters)	Broken Arrow, Okla. (233 meters)				Due West, S. C. (217 meters)				Ellendale, N. Dak. (444 meters)				Groesbeck, Tex. (141 meters)				Royal Center, Ind. (225 meters)				Washington, D. C. (34 meters)			
	Mean		Normal		Mean		Normal		Mean		Normal		Mean		Normal		Mean		Normal		Mean		Normal	
	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.
Surface	S. 5° W	3.7	S. 6° W	4.0	S. 76° W	3.8	S. 74° W	1.5	N. 3° W	0.5	N. 56° W	0.4	S. 15° W	5.3	S.	3.6	S. 16° W	1.7	S. 50° W	1.6	S. 67° W	0.4	N. 47° W	0.6
250	S. 5° W	3.8	S. 6° W	4.1	S. 77° W	4.4	S. 76° W	1.7					S. 14° W	7.3	S. 1° W	4.3	S. 23° W	1.8	S. 47° W	1.6	N. 72° W	1.9	N. 60° W	2.0
500	S. 4° W	4.4	S. 10° W	5.5	S. 69° W	6.4	S. 76° W	2.5	N. 57° E	0.3	N. 71° W	0.3	S. 17° W	11.1	S. 6° W	5.9	S. 28° W	3.9	S. 50° W	3.0	N. 63° W	3.7	N. 54° W	3.0
750	S. 5° W	4.6	S. 15° W	6.0	S. 74° W	7.3	S. 77° W	3.1	S. 4° W	0.9	S. 39° W	0.8	S. 21° W	12.4	S. 9° W	6.5	S. 25° W	5.0	S. 54° W	4.0	N. 73° W	4.2	N. 53° W	3.0
1,000	S. 18° W	4.8	S. 24° W	6.1	S. 74° W	8.4	S. 75° W	3.5	S. 27° W	1.3	S. 48° W	1.2	S. 27° W	12.8	S. 14° W	6.8	S. 42° W	5.0	S. 66° W	4.6	N. 74° W	5.2	N. 50° W	4.3
1,250	S. 28° W	5.3	S. 28° W	6.2	S. 77° W	9.2	S. 79° W	4.5	S. 43° W	1.3	S. 65° W	1.9	S. 31° W	12.4	S. 14° W	7.0	S. 51° W	5.6	S. 72° W	5.1				
1,500	S. 40° W	5.1	S. 33° W	6.2	S. 73° W	10.0	S. 77° W	5.6	S. 50° W	1.5	S. 69° W	2.3	S. 32° W	11.3	S. 16° W	6.5	S. 59° W	6.5	S. 80° W	5.2	N. 85° W	6.7	N. 57° W	6.0
2,000	S. 56° W	5.8	S. 39° W	6.3	S. 73° W	11.3	S. 81° W	7.5	S. 69° W	1.9	S. 78° W	3.4	S. 38° W	9.6	S. 17° W	6.0	S. 61° W	8.9	S. 83° W	7.5	S. 84° W	10.0	N. 70° W	7.3
2,500	S. 78° W	6.0	S. 43° W	6.3	S. 75° W	11.3	S. 80° W	8.0	N. 78° W	2.4	S. 83° W	5.1	S. 52° W	6.8	S. 15° W	5.3	S. 69° W	13.7	S. 81° W	9.6	S. 81° W	11.0	N. 72° W	6.2
3,000	N. 82° W	8.6	S. 48° W	6.5	S. 82° W	11.2	S. 85° W	9.2	N. 75° W	5.2	S. 89° W	7.2	S. 89° W	6.6	S. 16° W	5.2	S. 63° W	15.2	S. 84° W	11.1	S. 84° W	11.2	N. 82° W	8.9
3,500	N. 62° W	11.7	S. 54° W	6.8	S. 71° W	11.6	S. 83° W	10.3	S. 78° W	7.8	S. 89° W	9.2					S. 60° W	15.9	S. 82° W	11.5	S. 84° W	11.5	N. 74° W	9.3
4,000	N. 45° W	13.4	S. 68° W	7.6	W	9.0	S. 82° W	9.9	S. 84° W	10.7	N. 88° W	11.7					S. 50° W	10.1	N. 89° W	11.7	S. 83° W	10.3	N. 70° W	9.9
4,500					W	10.0	N. 72° W	12.5	N. 67° W	19.2	N. 79° W	13.6					S. 59° W	10.9	N. 80° W	10.0	N. 84° W	10.2	N. 68° W	9.8
5,000									W	23.0	N. 74° W	15.3									N. 83° W	11.0	N. 68° W	9.6

WEATHER IN THE UNITED STATES

THE WEATHER ELEMENTS

By P. C. DAY

GENERAL CONDITIONS

The weather of June, 1928, in the United States was notable in several respects:

The average atmospheric pressure was on the whole unusually low, though individual cyclones were without decidedly deep centers; the average temperature was likewise unusually low, particularly over the eastern two-thirds, the month being the coolest of record for June in a few instances and much similar to June, 1927, another unusually cool month. Rainfall was frequent and at times unusually heavy over the eastern two-thirds of the country; many localities had monthly amounts far above the normal for June, a number had amounts in excess of those for any previous June, and a few in excess of the greatest previously reported in any month; while the number of rainy days and amounts of cloudiness were in many instances equal to or in excess of those for any previous June. On the other hand, a few sections of the far Southwest had almost continuous sunshine, though the temperatures were not unseasonably high.

PRESSURE AND WINDS

While cyclonic conditions persisted with unusual frequency throughout the month over central and eastern districts, the barometric depressions were rather weak and confined to fairly short paths, but precipitation was frequently heavy over large areas.

A depression that appeared over the southern Rocky Mountains on the morning of the 3d became of considerable importance within the following 24 hours and during the 5th and 6th extended its influence over nearly all districts from the Mississippi River eastward. Heavy rains attended this depression in the Gulf and Atlantic Coast States, nearly 10 inches falling at Montgomery, Ala., during the 3d to 6th, and even larger amounts at some other points in that locality.

A cyclone of only moderate strength, passing eastward over the Northern States from the Dakotas to the Great Lakes and New England from the 7th to 10th, with an extension southward into the Mississippi Valley, brought widespread rains in portions of the Central and Northern States of the area covered, with heavy falls in a few localities.

On the morning of the 11th low pressure developed over the central Rocky Mountain region and during the following 48 hours passed to the northward of the Great Lakes attended by important precipitation over many portions of the central valleys and even into the Gulf States.

During the latter part of the second decade and the early part of the third a series of low-pressure areas passed over the central valleys, usually advancing northeast-